ECOLOGICAL NOTES ON *PODABRUS* (COLEOPTERA: CANTHARIDAE).

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ABSTRACT

Ecological notes are recorded from observations made during collecting trips throughout western U.S. during the last few years. To these have been added the sparse published notes. Specific subjects discussed are: unexplainable aberrant behavior; foliage preferences in different areas; feeding habits; moisture requirements; temperature or humidity; escape mechanisms; and ambiguous associates.

INTRODUCTION

There are few published notes on the habits of the family Cantharidae. Most of these have been merely records of feeding on aphids. In some of these, the species were misdetermined. The few notes I have been able to find offer little more than an introduction to these habits.

Wood (1883) noted that the Cantharidae, although being soft bodied, are among the most quarrelsome of insects and, at the least provocation, fight to the death. He stated that it was the custom for boys to catch these beetles and set them to fighting, the winner eating the loser after killing it (regardless of species or sex). I have never observed this phenomenon.

Adults of *Podabrus* are generally collected from foliage, by sweeping grasses and low herbage, or by beating branches of shrubs and trees. Mani (1968) mentioned that the Palearctic *Podabrus obscuripes* Sahlb. was found under stones on crowberry (*Empetrum*) meadows above timberline. He mentioned that *Podabrus lateralis* LeC. had been found at elevations up to and above 3960 meters on the Rocky Mountains of Colorado.

EARLY STAGES

Larvae of *Podabrus* are largely carnivorous. Those of some species are abundant in the debris of the forest floor. This is particularly true in coniferous forests. Those of others may be found in the ground among grass roots. They all have a velvety covering of fine hairs and may be gray to brown and yellowish to pink.

Payne (1916) mentioned that the fine hairs of the larvae of *Cantharis lituratus* Fallen permit them to live for a long time in water. The same is probably true for the larvae of *Podabrus,* a genus closely allied to *Cantharis.*

Essig (1926) noted that the eggs of *Podabrus tomentosus* (Say) (actually *P. pruinosus* LeC.) are oblong, pale yellow, and laid in masses on or in the soil where larvae live. Larvae are 15 to 20 mm long, pink with 2 dark lines on the dorsum of the thoracic segments, and have a velvety cover of fine hairs. The pupae occur in a cell 3 to 6 inches deep in the ground. The misidentification was based on LeConte's (1881) conclusion that *P. pruinosus* was synonymous with *P. tomentosus.* Fall (1928) confirmed the validity of the former. *P. tomentosus* occurs from New Jersey to Kansas and South Dakota, whereas *P. pruinosus* is found from the Rocky Mountains to the Pacific Coast.

Feeding Habits of Adults

On 15 July 1970, I observed a specimen of *Podabrus piniphilus* Esch. feeding on a large species of woolly homopteron at Twin Bridges Forest Camp, Mount Hood National Forest, Oregon. As it was being collected it did not release its prey. These woolly homopterans were fairly abundant on alders (*Alnus sp.*). Blatchley (1910) noted a specimen of *Podabrus rugosulus* LeC. (*P. rugulosus* Auct.) feeding on a winged aphid. Essig (1926) reported *Podabrus comes* LeC. (currently considered a color variety of *pruinosus*) feeding on aphids and common in Arizona, California, Oregon, and Montana. He also mentioned *P. tomentosus* (Say) (*P. pruinosus* LeC.) freely feeding on all kinds of aphids in California and Oregon. Smith (1936) reported several species of *Podabrus* at times effectively controlling the mealy plum aphid, *Hyalopterus pruni* (Geoffroy), in California. Clausen (1940) mentioned many species of *Podabrus* feeding extensively on aphids. Jacques (1951) reported that *Podabrus rugosulus* LeC., *P. modestus* (Say), and *P. tomentosus* (Say) were valuable aphid destroyers. The first 2 are found in the eastern half of the U. S., and the latter species is known from east of the Rocky Mountains.

The following observations were made on collecting trips during the last few years. They are more or less ecological in character but with incongruities that challenge comprehension. The short time at any one locality and the small amount of equipment makes almost all results inconclusive. Collections were made in the western states from the east slope of the Rocky Mountains to the Pacific Ocean and from the southern half of British Columbia to the Mexican border. Most of my trips were in the company of my son, William. In the spring of 1969, a trip to the San Bernardino and southern Sierra Nevada Mountains of California was taken with Mr. Frank Beer of Oregon State University.

Moisture

Podabrus species are usually found most abundantly adjacent to, or comparatively close to, some water source, such as lakes, streams, meadows, etc. Beyond a half mile from such a water source, the species become decidedly scarce or absent. This is especially true of montane species which are most common on foliage directly over the water. Due to the propensity of these montane species for higher elevations and an adjacent water source, their consequent isolation and speciation have created taxonomic problems. *Podabrus* are generally rather heavy flyers, and they apparently do not move far from their place of origin. The problem of speciation has been especially evident in the southwest where the mountain ranges have broken up into isolated mountain groups separated by comparatively wide expanses of dry plains and deserts.

Near Onyx Summit, San Bernardino Mountains, California, 28-VI-1969 (8000 feet), the weather was quite warm. Late in the afternoon, Frank Beer and I collected along a small stream flowing over a gravelly bed. Along the margins were grasses, flowers, and a rather low willow (*Salix* sp.) in clumps. *Podabrus gracilis* Fall was common on the willow branches overhanging the creek, but they were absent on the side of the willows away from the water.

On the same day, along the Santa Ana River at Seven Oaks, San Bernardino Mts., Cal. (5300 feet), several species of *Podabrus* were taken. The most abundant were *P. gracilis* and an undescribed subspecies of *Podabrus pruinosus* LeC. While a few were collected from alders (*Alnus* sp.), most were on grasses and herbs overhanging, or growing out of, the water. The beetles were frequently so near the water that sweeping or beating was difficult, and hand picking was the easiest way of collecting them.

At Union Creek Forest Camp near Crater Lake National Park, Oregon, 28 June 1967, low alders and vine maples (*Acer circinatum* Pursh.) were densely overhanging the creek. My son, Bill, collected numbers of *Podabrus lygarius* Fender by wading in the ice cold water and beating the overhanging branches, while I collected only 2 or 3 on the landward side.

TEMPERATURE

On extremely warm days, *Podabrus* tend to become inactive during the hottest part of the day. Where they go during this time is not known.

A favorite collecting area of mine for years has been the Metolius River on the eastern edge of the Cascade Range in Oregon. The rather narrow valley cut by the river gets hot on sunny summer days. Then *Podabrus* are active in the late morning, after the dew is gone; and in the late afternoon, as the day begins to cool. In the interim they disappear. This pertains to all species of *Podabrus* found here, the more common of which were *Podabrus piniphilus* Esch., *P. instabilis* Fall, *P. cavicollis* LeC., *P. pustulatus* Fend., and *P. cascadensis* Fend.

At Kaibab Lake Forest Camp, Kaibab National Forest, Arizona, 27 June 1968 (about 7000 ft.) and Cave Spring Forest Camp, Oak Creek Canyon, Arizona, 28-29 June 1968 (5000 ft.), the days were very hot (reported 119° F at Phoenix on the 28th). Only 2 specimens of *Podabrus* (sp. undet.) were taken during 3 days, and these were flying slothfully. However, at night they were fairly abundant at the lantern set up to attract insects. An all-out effort to find them during the daytime failed. At Kaibab Lake, the water was very low and remote from any vegetation. It may be that humidity, rather than temperature, is the limiting factor.

A number of *Podabrus* seem to be less affected by cold. At Huntington Lake, Fresno County, California, 1 July 1969 (6950 ft.), the weather was so cool that, in the shaded areas where snow banks still existed, I was shaking from the cold. Despite the chill, beating the evergreen trees overhanging a small creek produced several specimens of *Podabrus gracilis* Fall. They were almost invariably on the shaded portions of the trees.

FOLIAGE SELECTIVITY

Blatchley (1910) recorded the following: *Podabrus tomentosus* (Say) abundant on the great ragweed (*Ambrosia trifida* L.) along borders of streams; *P. brunnicollis* Fab. beaten from oak, hickory, and wild grapes; *P. frater* LeC. sweeping herbage in low moist places.

In some areas, *Podabrus* species display a proclivity for the foliage of a certain species of plant. In other areas, the same species will prefer an entirely different plant, although the original plant is present and even dominant (e.g., *Podabrus lateralis* LeC.). This is a high altitude species of the Rocky Mountains (9,000-13,000 ft.) and is frequently associated with *Podabrus obscureovitatus* Fall.

In the Cedar Breaks country of southern Utah, I collected at timberline (11,000 ft.) on Brian Head. *P. lateralis* was abundant on the leeward side of clumps of spruce (*Picea engelmanni* Engel.), but they were absent from herbs and shrubs. The intersection of the Brian Head road with the Cedar Breaks-Parowan highway (10500 ft.) lies in a flat, damp, upland grassy area of considerable extent. Here a number of small isolated spruce groves occur (all similar in size). The trees were all heavily infested with a pale green species of aphid. On some of the groves, *P. lateralis* was common along with a species of *Cephaloon* (Cephaloidae). On adjacent groves, both species were absent, although there was no apparent difference between the groves.

Below Cedar Breaks (to the south) lies Midway Valley, the floor of which is a damp grassland with a small stream running through it. The sides of the basin are bordered by spruce forests. In this area, *P. lateralis* was abundant on the trees at the edge of the forest. A few more were also swept from the grasses bordering the stream. There were none on the grasses near the trees.

Avintaquin Forest Camp, Ashley National Forest, Utah, is on a large, wet, upland meadow, surrounded on 3 sides by dense spruce forests. Occasional isolated trees or tree clumps intrude on the meadow. On 30 July 1967, *P. lateralis* was almost exclusively confined to one isolated tree in the meadow. The tree was not as remote from the forest as some others nor as close as still others. There was no apparent food supply on that tree that was not to be found on neighboring trees. Sweeping the meadow was unproductive.

Los Conchos Picnic area, Jemez Mountains, New Mexico (9000 ft.), has a small stream along it with a wet meadowy area on one side in a fir, cedar, and spruce grove with branches of the trees overhanging the stream. The meadow is composed of reeds, grasses, lupines, and other unrecognized flowering plants. On 18 July 1968, *P. lateralis* was abundant on the plants of the meadow but absent from the branches of the trees. Unfortunately, I did not ascertain whether the beetles were confined to one species of plant.

Red River Pass, Carson National Forest, New Mexico (9800 ft.), has a small creek running through a narrow meadow. On 20 July 1968, sweeping this meadow produced a few *P. lateralis*. On the south side of the meadow is a dense spruce forest, the trees of which are small and close. Beating the branches of the margins of the forest also produced a few *Podabrus*. Nowhere were they common. About a mile west of Red River pass and about 300 feet lower, is a small rather open lateral draw with a temporary stream flowing through it in a small aspen grove. There was a sparse shrub area of young spruce, fir (*Abies* sp.), wild rose (*Rosa* sp.), and gooseberry (*Ribes* sp.). The herb layer was pretty well dried up. On the same day, *P. lateralis* and an undetermined *Podabrus* were beaten from the fir, rose, and gooseberry. Spruce and the herb layer yielded nothing.

Two days were spent above the Rocky Mountain Biology Laboratory, Gothic, Colorado, 23-24 July 1968. Bill and I camped at Avery Park Forest Camp. The first day was wet and cold with lightning storms in the higher mountains. Collecting was soggy and difficult and no *Podabrus* were found, despite considerable searching. The next morning cleared somewhat, and it was warmer. Our camp at 9,600 ft. was on the edge of a spruce-fir-aspen forest. Along the margin of the forest was a zone of lower, rather sparse willows on the edge of a large upland meadow through which meanders the upper reaches of the East River. Although all habitats were searched, *P. lateralis* and *Podabrus obscureovittatus* Fall were taken only on the willows.

Emerald Lake (10,000 ft.), a couple of miles north of Avery Park, has a bordering margin of willows at the lower end. Below this is a very wet marshy area of considerable size, in which are occasional hummocks on which are veritable hedges of low spruce. From this marshy area, at least one branch of the East River apparently originates. Along the margins of this incipient stream other willows are found. Again *P. lateralis* and *P. obscureovittatus* were found only on the willows.

About a mile beyond Emerald Lake, and on the north side of Schofield Pass (10700 ft.), is a small upland and a stream, along which were willows, spruce, fir, and a small upland glade of grasses and herbs. In this spot, *P. lateralis* and *P. obscureovittatus* were taken by beating spruce and sweeping the herb layer. Here the willows were destitute of *Podabrus*.

Mizpah Forest Camp, Arapaho National Forest, Colorado (9500 ft.), is in a spruce forest. Through one side of the camp ground flows Clear Creek. Along the banks of the creek and overhanging the banks are spruce, 2 species of willows, and other trees. The weather on 26-27 July 1968 was cool and showery, leaving the foliage wet most of the time. *P. lateralis* was abundant, but only on one species (undetermined) of willow.

Dumont Lake Forest Camp, Routt National Forest, Colorado (9,300 ft.), was warm and sunny on 29 July 1968. Our camp was about 1/4 mile from the lake and in a small spruce grove on a sloping rocky hillside. There were other similar spruce groves on the hillside. There were indications that the area might have burned over a number of years ago. *P. lateralis* and *P. obscureovittatus* were sparsely beaten from the spruce. The edges of the lake had narrow bands of sedges and reeds encroaching in the water. On these, *P. lateralis* was abundant, but *P. obscureovittatus* was absent.

Grout Bay Campground, Big Bear Lake, San Bernardino Mountains, California, was hot and dry on 25 June 1969. Frank Beer and I collected along a small creek that ran through a clutter of large to vast boulders, shrubs, criss-crossed logs, and dead branches in a narrow ravine that made collecting very difficult. *Podabrus gracilis* Fall was common on the lower branches of the shrubs directly above the water, making the collecting still more difficult. Later, Frank collected several specimens of *P. gracilis* from a single fir (*Abies concolor*) tree on a hillside several hundred feet from the creek. This was the only fir tree that yielded specimens, although Frank tried many more. He indicated that he could find no appreciable difference between that particular fir and neighboring firs.

Escape Mechanisms

Near Seven Devils Road, about 2 miles south of Charleston, Coos County, Oregon, *Podabrus lygarius* Fend., were seen flying around and landing on an isolated spruce tree (*Picea sitchensis* (Boug.) Trautv. and Mayer). One specimen landed on a twig, crawled awkwardly over the needles for a brief time, and settled down on a needle (its head at the base of the leaf and its body paralleling it). In this position of repose, it closely resembled the neighboring needles. Had it not been observed prior to settling down, it would have been virtually impossible to espy.

Cozine Creek, McMinnville, Oregon, runs through the middle of our acreage in a pasture land with one or two springs on it. Grasses and reeds abound, with brier patches of blackberry and wild rose encroaching thereon. Along the creek are willows and ash (*Fraxinus oregana* Nutt.). In April 1970, *Podabrus pruinosus* LeC. and *P. piniphilus* Esch. were observed on tall grasses. The most common resting position was with the head down or toward the base of the leaf. The beetles would fly in clumsily and alight with their heads up or toward the tips of the grass blades. After wandering up and down the blades for a bit, they settled down with their heads toward the base of the leaf or stem more than 75 percent of the time. In this head down position, the beetles were much more difficult to capture than in an upright position. They were much more willing to let go of the leaf and drop to safety, as though they could more readily see where they were falling.

This same reaction was observed at Devil's Garden, Deschutes National Forest, Oregon (6000 ft.) with *Podabrus danielsi* Fend. On 16 July 1970, they were collected by sweeping low sparse sedge clumps in a very wet upland meadow. Although few were observed, 3 specimens were found resting on the sedges in a head down position. From this position they dropped immediately (upon collector movement in their direction). Another specimen was seen to fly in and land on a sedge. While still moving around and in a heads up position, it was comparatively easily captured.

Ambiguous Associates

As mentioned before, at the intersection of the Brian Head road with the Cedar Breaks-Parowan highway, *Podabrus lateralis* and an undetermined species of *Cephaloon* were collected together from certain spruce groves, whereas they were both absent from other similar groves with no apparent explanation.

In a number of instances, species of the genus *Chasmatonotus* (Diptera: Chironomidae) have been observed running around on the same trees or shrubs from which *Podabrus* were usually collected in large numbers. They were also on plants that had no *Podabrus*. There is no evidence of any particular association between these flies and the beetles. It is probable that the *Chasmatonotus* are more noticeable because they run rapidly over the leaf surface. In addition, I was once particularly interested in this genus of flies.

At Prairie Creek Redwoods State Park, Humboldt County, California, 20 June 1969, Frank Beer and I collected an undetermined (not saved) species of *Chasmatonotus* along with *Podabrus pruinosus* along the Ten Taypo trail.

On 14 July 1969, at Mount Hood Meadows (timberline), on the east side of Mount Hood, Oregon (5650 ft.), the principal plants were willows, fireweed (*Epilobium angustifolium* L.), lupines, mountain hemlock (*Tsuga mertensiana* (Bong.) Sarg.), alpine fir (*Abies lasiocarpa* (Hook.) Nutt.), sedges, false hellebore (*Veratrum viride* Ait.), indian paint brush (*Castilleja* sp.) and goldenrod (*Solidago* sp.). *Podabrus lygarius* was collected by beating willows and sweeping the shorter herbage. *Chasmatonotus maculipennis* Rempel was abundant on the willows.

On the same day, at the junction of the Mount Hood Meadows road with the Mount Hood Loop highway (5000 ft.), we collected in a thick forest of mountain hemlock, alpine fir, huckleberry (*Vaccinium* sp.), false hellebore, vanilla leaf (*Achlys triphylla* (Smith) DC) and sedges along a small mountain rill. *P. lygarius* was collected from the hemlock and huckleberry by beating with no attempt at sweeping. *Chasmatonotus univittatus* Coq. was common on huckleberry and vanilla leaf.

At Still Creek Forest Camp on the south side of Mount Hood, the same day (4000 ft.), *P. lygarius* was collected from the foliage of the creek margin along with *Chasmatonotus maculipennis*. Still Creek is a mountain stream in a previously dense forest in which the camp sites have been cut and cleared, with alders, elderberry (*Sambucus glauca* Nutt.), gooseberry (*Ribes* sp.), brake fern (*Pteridium aquilinum* ssp. *pubescens* Underw.), horsetail (*Equisetum* sp.), thimbleberry (*Rubus parviflorus* Nutt.) and cow parsnip (*Heracleum lanatum* Mich.) on its margin. The forest is cedar, mountain hemlock, alpine fir and douglas fir.

Many more instances could be cited but they would be largely repetitious.

SUMMARY

During collecting trips over the last 4 years, daily logs were kept. From these logs emerged patterns of behavior, of which some could be partially correlated with temperature and moisture requirements. Others indicated foliage preferences that vary from area to area. There also occur inconsistencies to the patterns that are at present unexplained. Although incomplete, I feel that these findings should be made available at this time. Hopefully they are only a beginning toward a more complete knowledge of *Podabrus*.

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BOOK NOTICE: *At a bend in a Mexican River*, by George Miksch Sutton. 1972. Paul S. Eriksson, Inc., 119 W. 57th St., New York, N. Y. 10019. 8½ × 11", 184p., 30 paintings (12 in color), 17 photos; cloth, $14.95.

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